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reproducibility. Thus, 500 mL prehydrolyzate was pptd. at ambient temp. for 24 h, the ppt. was dispersed in H<sub>2</sub>O and the prehydrolyzate was filtered and centrifuged. The sepd. ppt. was dissolved in 25 mL 0.1N NaOH, dild. and analyzed spectrophotometrically at 280 nm. The spectrophotometric anal. gave 3.20 g/L sludge and 2.55 g/L resin, compared with 3.39 and 2.85, resp., by gravimetry.

109: 151782b Manufacture of pulp for filter and accumulator separator paper. Petre, Ana; Meticaru, Nicolae; Bosinceanu, Radu (Institutul de Cercetari pentru Fibre Artificiale, Celuloza si Hirtie, Braila) Rom. RO 93,425 (Cl. C08B15/02), 30 Jan 1988, Appl. 121,645, 31 Dec 1985; 3 pp. Pulp for replacing cotton linters in the manuf. of the title paper is prep. by treatment of bleached softwood sulfate pulp 50-80 min with a 210-250 g/L NaOH soln. at 16-30° and bath ratio 1-20 and washing with water at 60-85°, with a part of the wastewater being recycled until the hemicellulose content in the treatment soln. is 15-60 g/L. The pulp exhibits  $\alpha$ -cellulose content >95%, 10%-NaOH soln.-material content <5%, 18%-NaOH soln.-material content <3%, d.p. >800, breaking length  $\geq 2000$  m (15° SR milling), and air permeability  $\geq 3000$  cm<sup>3</sup>/min (15° SR milling, water pressure difference 1 mm).

109: 151783c Improved alkaline sulfite/quinone pulping of lignocellulose. Oi, Hiroshi (Kawasaki Kasei Chemicals, Ltd.) Jpn. Kokai Tokkyo Koho JP 63,126,984 [88,126,984] (Cl. D21C3/00), 30 May 1988, Appl. 86/266,619, 11 Nov 1986; 4 pp. In the pulping with alk. Na sulfite and quinone derivs., improved delignification and pulp yield are obtained by addn. of 0.15-0.7 mol HCHO per mol Na sulfite to cooking liquors. Thus, cooking spruce wood meals with a soln. contg. 0.6 mol/L Na<sub>2</sub>SO<sub>3</sub> and 0.1% (wood basis) 1,4-dihydro-9,10-dihydroxyanthracene Na salt and HCHO (HCHO/Na<sub>2</sub>SO<sub>3</sub> mol ratio 0.5:1) at 170°, a liquor ratio 1:10 and pH 12.8 for 75 min gave pulp with 70.8% in yield and lignin content 9.0%, vs. 75.0 and 12.2, resp., without HCHO.

109: 151784d Method and apparatus for combustion of soda black liquor. Kiiskila, Erkki (Ahlstrom, A. Corp.) PCT Int. Appl. WO 88 03,191 (Cl. D21C11/04), 05 May 1988, FI Appl. 86/4,436, 31 Oct 1986; 12 pp. In combustion of S-free soda black liquors in the presence of Fe oxide (forming Na ferrite) in a fluidized bed reactor provided with a circulating bed, a particle fraction having a size greater than 50  $\mu$ m is sepd. (ie. in a cyclone) from the flue gases and recycled into the fluidized bed reactor for further reaction with Na compds., resulting in substantial decrease in the vol. of Fe oxide required in the combustion process.

109: 151785e Method for producing salts of monoperoxysulfuric acid and simultaneously bleaching pulp. Springer, Edward L.; McSweeney, James D. (United States Dept. of Agriculture) U.S. US 4,756,800 (Cl. 162-64; D21C3/00), 12 Jul 1988, Appl. 903,174, 03 Sep 1986; 7 pp. Salts of H<sub>2</sub>SO<sub>5</sub> are generated in situ and pulp is simultaneously bleached by reacting together a soln. of aerated H<sub>2</sub>O having a pH 8-14 with SO<sub>2</sub> or a sulfite in the presence of 0.01-100 ppm Cu<sup>2+</sup> ions as a catalyst at 0-80°. Kraft pulp was pretreated with CuSO<sub>4</sub> soln. (total of 17 ppm), mixed with aerated water, into which Na<sub>2</sub>SO<sub>3</sub> was being fed at the rate of 0.167 and L/min for 120 min. The pulp (having initial brightness 53.4%) was simultaneously bleached to a brightness level 69.6%.

109: 151786f Total recycling of phenol in pulping of lignocellulosic materials. Ekman, Kurt (Neste Oy) Eur. Pat. Appl. EP 273,759 (Cl. D21C9/02), 06 Jul 1988, FI Appl. 86/5,360, 31 Dec 1986; 7 pp. In pulping of lignocellulosic materials with PhOH, total recycling of PhOH is carried out by using a spent PhOH soln. from pulping in washing the pulp, and finally using the spent washing PhOH-contg. soln. in impregnation of lignocellulosic materials prior to pulping. The total recycling of PhOH in pulping of birchwood chips at 102° gave pulp in 49.3% yield and lower chlorine no. than that obtained without removal of spent pulping liquor. The PhOH-contg. soln. displaced in the washing step was cooled down to form a PhOH-rich phase and a H<sub>2</sub>O-contg. phase, and thereafter the PhOH-rich phase was used to displace the impregnating soln. from birchwood chips and to digest the chips, whereas the H<sub>2</sub>O-contg. phase was recycled.

109: 151787g Washing of alkaline pulps in presence of carbon dioxide. Bokstrom, Monica; Rasimus, Raimo (AGA AB) PCT Int. Appl. WO 88 04,705 (Cl. D21C9/02), 30 Jun 1988, SE Appl. 86/5,510, 22 Dec 1986; 12 pp. Addn. of CO<sub>2</sub>, and optionally, a mineral acid during washing of alkali pulps to a pH ~5-7 greatly reduces washing losses of inorg. ions and the washout of substances which give rise to COD. Particularly good results are obtained by adding H<sub>2</sub>SO<sub>4</sub> to the last washing stage. Thus, the washing of kraft pulp with a washing liquor contg. 6 kg CO<sub>2</sub>/ton pulp reduced the washing loss by ~6 kg/ton pulp.

109: 151788h Streamlined refining of pulp in the presence of nitromethane. Rubinova, F. Ya.; Leonovich, A. A.; Loginov, O. A. (Leningrad Technological Institute) U.S.S.R. SU 1,397,582 (Cl. D21C9/00), 23 May 1988, Appl. 4,167,109, 22 Dec 1986. From Otkrytiya, Izobret. 1988, (19), 122. The refining of pulp is streamlined in the content of  $\alpha$ -cellulose is maintained by treating chlorinated pulp with aq. NaOH in the presence of Na<sub>3</sub>PO<sub>4</sub> and 0.1-2.0 wt.% MeNO<sub>2</sub>.

109: 151789j Manufacture of semichemical pulp in the presence of oxygen. Deineko, I. P.; Evtyugin, D. V.; Zarubin, M. Ya. (Leningrad Forestry Academy) U.S.S.R. SU 1,397,581 (Cl. D21C3/20), 23 May 1988, Appl. 4,164,688, 22 Dec 1986. From Otkrytiya, Izobret. 1988, (19), 122. The manuf. and yield of semichem. pulp are enhanced and environmental pollution is decreased by pulping cellulosic feedstock in a mixt. of an aprotic org.

109: 151790c Process for solids retention and accelerated dewatering in paper manufacture. Jaeger, Werner; Wandrey, Christine; Hahn, Mathias; Nicke, Rolf; Pensold, Sabine; Borchers, Bernhard; Tappe, Monika (VEB Zellstoff und Papier Heidenau-Stammtrieb) Ger. Offen. DE 3,733,587 (Cl. D21H3/38), 14 Apr 1988, DD Appl. 295,033, 06 Oct 1986; 6 pp. In the title process, which improves productivity and wastewater clarity, paper is prep. from pulp slurries contg. 0.1-1.5% solids and 0.01-0.5% (based on solids) highly-branched, high-mol.-wt. copolymer of diallyldimethylammonium chloride (I) with 0.1-3.0 mol% crosslinking monomers. A slurry of 0.8% fibers (wastepaper) contg. 0.02% I copolymer with 0.1 mol% triallylmethylammonium chloride had dewatering time (250 mL filtrate) 5.1 s and gave a sheet contg. 97.5% solids, vs. 5.7 and 95.2, resp., with I homopolymer, and 6.5 and 93.1, resp., with no polymer.

109: 151791d Agent for improving the printability of paper and cardboard. Dessauer, Guido; Berenbold, Helmut (Technische Universitaet Graz; Hoechst A.-G.) Ger. Offen. DE 3,634,277 (Cl. D21H3/12), 21 Apr 1988, Appl. 08 Oct 1986; 8 pp. The title additive, which minimizes the penetration of printing inks or coating compns. in paper or cardboard, contains 5-50% mixt. comprising 1-50% quaternary ammonium salts contg. C<sub>8-22</sub> alkyl groups or a compn. contg. 50-99.5% org. quaternary ammonium or amine salts and 0.5-50% C<sub>8-22</sub> fatty acids, oxidized waxes, or polyalkylene glycols with mol. wt. >4000 and 50-99% anionic hydrophilic polymers, and 95-50% H<sub>2</sub>O. Thus, a printing paper (40 g/m<sup>2</sup>) coated with 2.90 g/m<sup>2</sup> mixt. of (C<sub>18</sub>H<sub>37</sub>)<sub>2</sub>NMe<sub>2</sub><sup>+</sup> Cl<sup>-</sup> 20.0, oxidized starch 162.0, and H<sub>2</sub>O 820 parts was printed with color d. 2.04%, strike-through value 3.7, and Lehmann gloss 3.83; vs. 1.61, 20.6, and 2.23, resp., with no coating.

109: 151792e Paper sizes for improved surface strength and high sizing degree. Kurokawa, Akio; Yamaguchi, Takamine (Mitsui Toatsu Chemicals, Inc.) Jpn. Kokai Tokkyo Koho JP 62,299,598 [87,299,598] (Cl. D21H1/34), 26 Dec 1987, Appl. 86/133,858, 11 Jun 1986; 7 pp. Title sizes, useful for papers with or without alum, consist of aq. dispersions comprising 50-99.50-1 (solids) mixts. of water-sol. polymers and latexes of copolymers contg. 3-50% F-contg. vinyl monomers. Thus, 2 parts 50% (solids) SBR latex contg. styrene 60, butadiene 24.5, N-propyl-N-[ $\beta$ -(acryloyloxy)ethyl]-perfluorooctanesulfonamide 1.4, and acrylic acid 1.5% was mixed with 10% aq. starch 33, 10% aq. poly(vinyl alc.) 15, and H<sub>2</sub>O 50 parts to give a 5% (solids) aq. dispersion. An alum-free base paper was impregnated with this mixt., squeezed, and dried at 110° for 3 min to give a surface-sized paper showing Stoeckigt sizing degree 41 s and good surface strength, vs. 18 and fair, resp., using a size contg. a petroleum resin latex instead of SBR latex.

109: 151793f Paper additives for improved freeness and strength. Kurokawa, Akio; Suzuki, Yoshiharu; Toki, Hirotoshi; Yodoya, Takashi (Mitsui Toatsu Chemicals, Inc.) Jpn. Kokai Tokkyo Koho JP 62,299,599 [87,299,599] (Cl. D21H3/38), 26 Dec 1987, Appl. 86/139,209, 17 Jun 1986; 6 pp. Title additives contain copolymers comprising (R<sup>1</sup>C<sub>6</sub>H<sub>4</sub>CH<sub>2</sub>)(CH<sub>2</sub>CR<sup>2</sup>CONHA)N<sup>+</sup>R<sup>3</sup>R<sup>4</sup>X<sup>-</sup> (I: A = lower alkylene; R<sup>1</sup> = H, Me; R<sup>2</sup> = lower alkyl; R<sup>3</sup> = H, lower alkyl; X = anion) 1-50, unsatd. carboxylic acids and/or their salts 1-20, and (meth)acrylamide 30-99 mol%. Thus, 40% aq. acrylamide (II) 163.3, 50% aq. I (A = C<sub>6</sub>H<sub>5</sub>; R<sup>2</sup> = Me, R<sup>3</sup> = R<sup>4</sup> = H, X = Cl) (III) 28.3, and 80% aq. acrylic acid (IV) 2.7 g were polymd. at pH 4.0-4.2 in the presence of 1.5 g 10% aq. (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> and 0.75 g 10% aq. (NH<sub>4</sub>)HSO<sub>4</sub> at 45° for 3 h to give an additive (nonvolatile content 15.2%). Paper made from pulp, alum, anionic polyacrylamide, and the additive showed sp. bursting strength 2.42, sp. compressive strength 17.6, and freeness (JIS 8121) 533 mL, vs. 2.23, 15.8, and 310, resp., using 98.5:0.5:1 (mole ratio) II-III-IV copolymer.

109: 151794g Neutral sizing compositions. Kurisu, Takehiko; Kato, Hideo (Lion Corp.) Jpn. Kokai Tokkyo Koho JP 63 42,996 [88 42,996] (Cl. D21H3/08), 24 Feb 1988, Appl. 86/184,196, 07 Aug 1986; 7 pp. Title compns., with improved sizing effect and mech. strength, contain hydrocarbyl-substituted succinic anhydrides and betaine ester-type surfactants. Thus, 100 parts C<sub>18</sub> alkenylsuccinic anhydride and 10 parts cetostearyl betaine ester chloride (I) were mixed to give a size. A paper manuf. from pulp, CaCO<sub>3</sub>, cationic starch, and aq. emulsion of the size showed Stoeckigt sizing degree 16 s and burst factor 1.28, vs. 0 and 1.28, resp., for the paper without I.

109: 151795h Cationized acrylamide copolymers as strengthening agents for neutral paper. Matsunaga, Yoshiki; Sugiyama, Toshiaki (Kyoritsu Organic Industrial Research Laboratory) Jpn. Kokai Tokkyo Koho JP 63 66,398 [88 66,398] (Cl. D21H3/58), 25 Mar 1988, Appl. 86/208,574, 04 Sep 1986; 5 pp. The title agents comprise aq. dispersions of copolymers of (meth)acrylamide 30-70, cationizable monomers H<sub>2</sub>C=CR<sup>1</sup>COABNR<sup>2</sup>R<sup>3</sup> (R = H, Me; A = O, NH; B = C<sub>2</sub>H<sub>4</sub>, C<sub>3</sub>H<sub>6</sub>; R<sup>1</sup>, R<sup>2</sup> = Me, Et) 5-30, styrene 20-50, and acrylate esters H<sub>2</sub>C=CR<sup>4</sup>CO<sub>2</sub>R<sup>4</sup> (R<sup>3</sup> = H, Me; R<sup>4</sup> = C<sub>4-8</sub> alkyl) 5-15 mol% at mol ratio of the first two hydrophilic monomers to the last two hydrophobic monomers  $\geq 1.0$ . Thus, paper made from pulp contg. 0.5% acrylamide-styrene (I)-octyl acrylate (II)-dimethylaminoethyl methacrylate (III) copolymer (mol ratio 35:40:10:15) cationized with 8.7 mol% epichlorohydrin showed burst factor 2133 vs. 720 for a blank and 1785 for paper made from pulp contg. I-II-III copolymer (mol ratio 50:20:30) cationized with 16.6 mol% epichlorohydrin.

109: 151796j Pigmented vinyl alcohol copolymer coating compositions for papers. Maruyama, Hitoshi; Ono, Isao; Aoyama, Akemasa; Moriwa, Takeshi; Yonezu, Kiyoshi; Yamauchi, Junnosuke (Kuraray Co., Ltd.) Jpn. Kokai Tokkyo Koho JP 63 85,198 [88 85,198] (Cl. D21H3/24), 24 Feb 1988, Appl. 86/184,196, 07 Aug 1986; 7 pp. Title compns., with improved sizing effect and mech. strength, contain hydrocarbyl-substituted succinic anhydrides and betaine ester-type surfactants. Thus, 100 parts C<sub>18</sub> alkenylsuccinic anhydride and 10 parts cetostearyl betaine ester chloride (I) were mixed to give a size. A paper manuf. from pulp, CaCO<sub>3</sub>, cationic starch, and aq. emulsion of the size showed Stoeckigt sizing degree 16 s and burst factor 1.28, vs. 0 and 1.28, resp., for the paper without I.

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Title:

PROCESS FOR SOLIDS RETENTION AND ACCELERATION OF DEWATERING  
DURING PAPERMAKING

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ABSTRACT:

A process for solids retention and acceleration of dewatering in papermaking which is used in the paper industry. To this end, a highly branched, high-molecular-weight, water-soluble copolymer of dimethyldiallylammonium chloride and from 0.1 to 3.0 mol % of a crosslinking comonomer is added to the paper-forming suspension in amounts of from 0.01 to 0.5%, based on the content of fibre raw materials and additives in this suspension, and the papermaking is carried out in a known manner.

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(54) Process for solids retention and acceleration of dewatering during papermaking

Process for solids retention and acceleration of dewatering during papermaking, used in the paper industry. For this purpose, a highly branched high-molecular-weight water-soluble copolymer of dimethyldiallylammonium chloride and 0.1 to 3.0 mole-% of a crosslinking comonomer, in proportions of 0.01 to 0.5%, based on the content of the paper-forming suspension of fibrous raw materials and additives, is added to the suspension and the paper production is done in the known manner.

DE 37 33 587 A 1

## Patent Claims

1. Process for solids retention and acceleration of dewatering in papermaking, in which the paper-forming suspension comprises fibrous raw materials and additives with solids contents of 0.1 to 1.5%, by adding water-soluble organic polymers, characterized in that a highly branched high-molecular-weight copolymer of dimethyldiallylammonium chloride and 0.1 to 3.0 mole-% of a crosslinking comonomer is added to the suspension in proportions of 0.01 to 0.5%, based on the solids content of the suspension.
2. Process according to Claim 1, characterized in that amine or ammonium salts with more than two allyl groups are used as the crosslinking comonomers.
3. Process according to Claims 1 and 2, characterized in that methyltriallylammonium chloride, tetraallylammonium chloride, triallylamine hydrochloride, N,N,N',N'-tetraallylethylenediamine hydrochloride or methylene bisacrylamide is used as the crosslinking comonomer.

## Description

The invention concerns a process for acceleration of dewatering and for retention of fibers, fillers, and fines in papermaking, with simultaneous reduction of wastewater treatment. The process is suitable for production of various types of paper or cardboard, distinguished by different fiber raw materials and additives.

In papermaking, the fiber raw materials such as ground wood pulp, ground cellulose, or disintegrated wastepaper, usually with other additives such as fillers or mineral pigments, in an aqueous suspension, is placed on a moving endless screen belt. That process removes a high proportion of water and forms a sheet. Then this sheet is further dewatered mechanically and dried. Use of industrial process additives is essential for high paper machine productivity with good material economy. The retention agents or dewatering accelerators are used as such additives. They have the primary purpose of increasing the retention of fibers, fines, and fillers on the paper machine screen. At the same time, they are intended to accelerate dewatering on the screen and in the following wet presses and dry units, as well as to contribute to wastewater treatment. The principal effects of the technical additives, retention and dewatering, are required for high production capacities through rapid and undisturbed running of the paper machine, and for power saving, particularly in the dry units, as well as for good material economy through extensive retention of all the solids on the screen. Improved retention simultaneously means reduced wastewater loading.

Poly(ethyleneimine), polyamines, polyamidoamines, and cationic or anionic acrylates are used as dewatering accelerators and retention agents (see Ullmann, *Enzyklopädie der technischen Chemie* [Encyclopedia of Engineering Chemistry], 4<sup>th</sup> Edition, Verlag Chemie, Volume 17, page 584; Zellstoff, Papier [Cellulose and Paper], 5<sup>th</sup> Edition, Fachbuchverlag Leipzig, p. 231 and 235-237). Of those, poly(ethyleneimine) has by far the widest use as a dewatering accelerator (Zellstoff, Papier, p. 236).

Other synthetic polymers have been tested as dewatering accelerators and retention agents, but have not been used industrially. One of those is linear poly(dimethyldiallyl ammonium chloride) (Poly-DMDAAC). This polymer provides less dewatering than poly(ethyleneimine), giving no increase in production over operation without additive at industrially relevant low proportions of use (Zellstoff und Papier 31 (1982), p. 19-23).

When a single polymer is used, the optima for solids retention, dewatering rate, and wastewater treatment often do not coincide. Instead, they occur at different times after the addition, or at different proportions of additive (Das Papier, 33 (1979) 10A, V 89-95). For that reason, mixtures of different polymers, e.g., of poly(ethyleneimine) and polyethylene oxide, were tested (Das Papier 29 (1975) V 32).

The known industrial additives have the disadvantage, though, that the dewatering rate, at good retention and wastewater treatment, is not sufficient to achieve sufficient increase of production capacities and material economy. It is often limited to just the first part of the screen, and is not sufficiently effective in the following technological segments. Use of mixtures of polymers has the further disadvantage that these mixtures are not universally usable and that added high demands must be placed on industrial management with respect to the exactly adjusted dosage.

The goal of the invention is a process in which higher material economy and increased productive capacity are achieved in papermaking by using industrial additives, simultaneously attaining good wastewater treatment.

The objective of the invention is to develop a process for increasing the space-time yield in papermaking through an increased rate of dewatering, with simultaneously good total retention of fibers, by adding a suitable water-soluble organic polymer.

The objective is attained according to the invention by adding, during papermaking, an aqueous solution of a water-soluble highly crosslinked high-molecular-weight copolymer of dimethyldiallyl ammonium chloride (DMDAAC) and 0.1 to 3.0 mole-% of a crosslinking comonomer, with a molecular weight of 80,000, at proportions of 0.01 to 0.5%, based on the solids content of the suspension of fiber raw materials and additives.

Suitable crosslinking comonomers for production of the highly branched poly-DMDAAC include, for example, amines or

ammonium salts with more than two allyl groups, including methyltriallylammonium chloride (MTAAC), tetraallylammonium chloride (TAAC), N,N,N'-tetraallylethylenediamine hydrochloride (TAEDC) and/or triallylamine hydrochloride (TAC), as well as methylene bisacrylamide (MBA). The highly branched poly-DMDAAC is produced by copolymerizing DMDAAC with the crosslinking comonomer in aqueous solution with the crosslinker metered in during the progress of the homopolymerization or copolymerization of the DMDAAC after conversions between 25 and 90%. The improved process for papermaking is carried out so that the desired amount of the polymer is metered in continuously or discontinuously in the known manner in the usual industrial equipment before or after during sheet formation. It can be used in all the known processes for producing paper or cardboard, which give different types of paper or cardboard, and require different fibrous raw materials and additives. The solids content of the suspension flowing onto the screen can be, for example, between 0.1 and 1.5%.

It was found, surprisingly, that when the highly branched poly-DMDAAC was used, there was a substantial increase in the rate of dewatering. This accelerated dewatering occurred not only on the screen but also in the presses and dry units. At the same time, very good results were achieved for retention and wastewater treatment. With constant good retention of fillers, the poly-DMDAAC is characterized by substantially higher activity on the fibers.

To demonstrate the acceleration of dewatering and the retention of the suspensions being treated, each of the following polymers was added in the specified proportion. The proportions of additive refer to the solids content of the suspension.

Table 1

Polymer	Symbol	Concentration in %
Polyethylene comparison example	A	0.02
poly-DMDAAC (homopolymer) – comparison example	B	0.02
Copolymer of DMDAAC and 0.1 mole-% MTAAC	C	0.02
Copolymer of DMDAAC and 0.5 mole-% MTAAC	D	0.02
Copolymer of DMDAAC and 1.5 mole-% MTAAC	E	0.02
Copolymer of DMDAAC and 1.5 mole-% MTAAC	F	0.01
Copolymer of DMDAAC and 1.5 mole-% MTAAC	G	0.04
Copolymer of DMDAAC and 1.5 mole-% MTAAC	H	0.08
Copolymer of DMDAAC and 1.5 mole-% MTAAC	J	0.5
Copolymer of DMDAAC and 1.5 mole-% MTAAC	K	0.02
Copolymer of DMDAAC and 1.5 mole-% TAAC	L	0.02
Copolymer of DMDAAC and 1.5 mole-% TAEDC	M	0.02
Copolymer of DMDAAC and 1.5 mole-% TAC	N	0.02
Copolymer of DMDAAC and 1.5 mole-% MBA	O	0.02

Example 1

The effects of substances in Table 1 on dewatering and drying were investigated on a long-screen experimental paper machine (working width 65 cm). In the testing, a 0.8% suspension of disintegrated wastepaper and other paper wastes without other additions of the substances in Table 1 was added continuously. The dewatering in the register part of the paper machine was measured by measuring the time needed to collect 250 ml of the wastewater. The dewatering in the suction part was determined by measuring the vacuum and the dryness at the end of the drying section. The corresponding values are shown in Table 2.

Table 2

Test No.	Polymer	Dewatering time, Register section, sec.	Vacuum, Suction part, decrease in %	Final dry material content, %
1	-	6.5	0	93.1
2	A	5.4	20	95.1
3	B	5.7	5	95.2
4	C	5.1	23	97.5
5	D	4.6	28	98.0
6	E	4.4	30	98.5
7	F	5.4	21	97.6
8	G	4.1	34	98.8
9	H	4.0	35	98.9
10	J	3.8	32	98.9
11	K	4.4	30	98.5
12	L	4.3	30	98.5
13	M	4.5	28	98.6
14	N	4.4	30	98.4
15	O	4.4	30	98.4

## Example 2

The specific surface of a suspension of ground wood pulp in water, and its change due to addition of water-soluble organic polymers shown in Table 1 were determined by permeability measurements. The method is a measure of the dewatering rate. The smaller the specific surface  $O_2$  becomes, the higher the dewatering rate is. In this test the fiber coating from a 1% suspension was compressed to a dry content of 20%, so that  $O_2$  describes the dewatering rate on the screen and in the pressing and drying sections. Table 3 shows the results.

Table 3

Experiment No.	Polymer added	$O_2$ m <sup>2</sup> /g
1	-	5.93
2	A	3.77
3	B	4.14
4	C	3.60
5	D	3.56
6	E	3.45
7	F	3.90
8	G	3.31
9	H	3.19
10	J	3.10
11	K	3.40
12	L	3.42
13	M	3.51
14	N	3.47
15	O	3.47

## Example 3

Filled paper sheets were formed in a laboratory pressure sheet-maker from a suspension of ground wood pulp and kaolin with a solids content of 0.8%. The effect of added water-soluble polymers on the ash content (based on the dry weight of the paper) and on the turbidity of the water separated was examined. Increasing ash content indicates increasing retention of the filler. Decreasing turbidity corresponds to increasing purity of the separated water. Table 4 shows the results.

Table 4

	Polymer	Concentration, %	Ash content, %	Turbidity, Scale divisions
1	-	-	13.1	86.5
2	A	0.02	15.5	78.0
3	A	0.04	16.1	69.0
4	B	0.02	15.2	75.5
5	B	0.04	15.9	68.0
6	D	0.02	15.5	77.0
7	D	0.04	15.9	70.0
8	G	0.02	15.7	75.0
9	G	0.04	16.1	68.0



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